Environmental Effects of Lower Zab Tributary on Benthic Invertebrates Species Diversity in Tigris River

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Abstract

Benthic invertebrates' diversity and some physical and chemical characteristics in Lower Zab tributary and Tigris River were studied. Monthly samples were collected from November 2001 to October 2002.

The results of the present study showed the turbidity in Tigris river before the confluence to be higher (34.4 NTU) compared to the other stations. Mean salinity was greater in Lower Zab tributary (0.33 %) compared to that in the river. Lower Zab tributary and Tigris River were good in Oxygen content, and a high dissolved oxygen value was recorded (7.9 mg/L) in Lower Zab tributary.

31 benthic invertebrate species were identified, 14 of which were arthropods, 8 species from both of the Oligochacta and Mollusca .One single species was identified from the Nemathelminthes. Species diversity varied from 1.9 in Lower Zab tributary to 2.7 in Tigris River after the confluence. The highest species density was recorded in Tigris River after the confluence was 359.1 ind/m^2 while the lowest species density was 12.74 ind/m^2 in Lower Zab tributary.

Introduction

Studies and researches related to the distribution and structure of benthic invertebrates are rare compared to the studies conducted on Iraqi water systems. The results show that 26 species were identified

in Thirthar arm and Tigris River (7), 24 species in the general estuary and 25 in Euphrates River (2).

Benthic invertebrates are considered as an important part in the food chain of aquatic environment (14), as well as in the consumption of organic Pollutants as a source of food. Therefore, They work towards a good water quality (15). Benthic invertebrates as well as other aquatic organisms are exposed and affected by the seasonal changes, location, and the characteristics of water.

Lower Zab is considered one of the five tributaries of Tigris River. Its length extends to 400 km, and covers an area of 22250 km^2 . The Lower Zab has a gravel base and a mean annual discharge of 233-245 m^3 /sec (19).

In addition to the differences in the geological nature of the surrounding ground , this may have some effect on the invertebrate diversity .

The present work aimed to study the structure of benthic invertebrate population in Lower Zab tributary and its subsequent effect on the environment and invertebrate diversity in Tigris River .

Materials and Methods

Four stations were selected, 1 and 2 in Lower Zab tributary while 3 and 4 in Tigris River (Fig.1). Station 3 location was before the confluence of the tributary and considered as a control. The location of station 4 was after the confluence to show the effects of Lower Zab on benthic invertebrates' diversity in Tigris River.

Monthly samples were collected from November 2001 to October 2002.

Water samples were collected from the middle of the river at a point 30 cm below the surface. Field measurements on some factors were carried out as air and water temperature , as well as dissolved oxygen , using an oxygen meter (YSI -51-B). Turbidity was measured using turbidity meter (HACH-16800). Water conductivity and pH were also measured using (pH-EC. TDC meter /HI-9811).

The quantitative and qualitative study of benthic invertebrates was carried out depending on samples collected at a distance of 1-3m from the riverbank at a depth of less than one-meter using Ekman dredge (15*15 cm and an area of 1125 cm^2). Four replicates were collected at a distance of one meter apart. The following references were used in

benthic invertebrate identification (9, 17). Species diversity value was also measured (5).

Results and Discussion

The water characters at the four stations are shown in table (1). The highest water temperature recorded during summer and early autumn months, while the lowest values were during winter. Highest turbidity recorded in Tigris River (34.4NTU) before the confluence of the Lower Zab tributary, this value decreased to (26.5 NTU) after the confluence. The results of the present study conceded with previous studies concerned the turbidity in Tigris River, which is related to the suspended solid particles during the period of heavy discharge and rain (5).

The values of pH ranged from 7.5 to 8.6 throughout the study and goes with previous studies (1, 6, 11), which pointed out the weak alkalinity of the inland Iraqi water. The highest salinity value recorded in Lower Zab tributary at station 2(0.33%) . Salinity value in Tigris River was (0.25%) before the confluence and increased to (0.28%) after the confluence of Lower Zab. Values of dissolved oxygen were relatively high , and the lowest recorded value during the period of the study was 5.2mg/L. Values of dissolved oxygen were higher in Lower Zab tributary, and that was due to high speed , good mixing and good ventilation (6,7,11).

31 benthic invertebrate species were recorded, 14 of which were arthropods, 8 species belonged to each of the oligochaeta and mollusca, while only one species belonged to the Nematoda was found (Table -2). The numbers of recorded species in the present study were more than the recorded species in both Al – Thirthar arm and Tigris River (7) and in AL-Khadisia Lake (13), but less than the recorded species in AL- Saglawia flush (8). Sometimes these differences can be related to the level of classification in the study, but all studies agreed upon the hact that, water insects are the dominated ones.

Three benthic invertebrate species dominated in all stations.

These species are *Paranais* . sp (Oligochaeta) ; *Chironomus* sp (insect larva), and *Lymnaea megasoma*_(Mollusca)(Table.2). The dominancy of *chironomus* sp in the rivers is related to its small size and fast movement, which helps the species to hide from predators (12). The dominance of *Lymnaea megasoma* and other mollusca

species in the Iraqi water could be related to the wide – range of tolerance to the environmental factors (18).

High density values of arthropoda were obvious at the four stations, these values were 7.26, 66.11, 46.8, 185.12 ind/m^2 respectively in stations 1,2,3 and 4, followed by oligochaeta and were 0.91, 31.93, 39.2 and 120.71 ind/m^2 respectively (figure -2 and table -2). Mollusca and Nematods were less in their density values. The results of the study pointed out the high density of the arthropoda in the Lower Zab tributary, which cause arthropods density to increase in Tigris River from 39.92% to 51.51% for before and after the confluence of the Lower Zab tributary, respectively. While the density of oligochaeta was higher in Tigris river, therefore, Lower Zab confluence produce no effect on the river density. Figure (3) shows the densities of benthic invertebrates at all stations during the period of the study. Lower Zab tributary produce no effect on the species diversity of Tigris River. The lowest species diversity value recorded in Lower Zab was 1.9, while the density values in Tigris River varied from 2.5 to 2.7 before and after the confluence of the Lower Zab, respectively. These values were close to the values obtained by Al- Lami (5), and could be due to the water quality of Tigris River which is in fact suitable to the presence, availability and diversity.

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Table(1): Range, Mean and standard deviations of the physical and chemical measurements for the surface water at the different stations during 2001-2002.

Station / Factors	Lower Zab tributary		Tigris river	
	1	2	3	4
Air Temperature °C	12-36	12-34	13.5-38	10-31
Water Temperature °C	11-27	10-27	10-28	10-24
pH	7.87-8.26 8.12±0.1	7.71-8.37 8.1±0.1	7.81-8.28 8.1±0.1	7.52-8.6 8.1±0.3
Salinity ‰	0.19-0.46 0.31±0.1	0.2-0.59 0.33±0.1	0.22-0.46 0.28±0.1	0.16-0.35 0.25±0.04
Turbidity NTU	0.37-111 27.1±30	0.2-109 22±30.7	0.24-185 34.4±54.8	2.57-72 26.5±23
Dissolved Oxygen mg/l	5.2-10 7.9±1.2	6.3-10.35 7.9±1.2	6.5-7.9 7.6±0.9	6.1-10.0 7.7±1.1

Table (2) : Benthic invertebrate species at the different stations during 2001 – 2002 .

- **The first number = Times of presence .**
- **The second number (in bracket) = Percentage density .**
- **The third number = Mean monthly density (ind/ m^2)**

Species / Stations	Lower Zab		Tigris River	
	1	2	3	4
Phylum: Nematoda Class: Adenophora Family: Camacomaimidae				
Rhabdolaimus minor		3(6,96)8,3	1(0,78)0,91	2(1,27)4,58
Phylum: Annelidae Class: Oligochaeta Family: Naididae				
Nars communis			2(2,34)2,75	
Paranais sp.	1(7,14)0,91	1(0,77)0,91	6(17,17)20,16	4(3,82)13,75
Pristina aequiseta		2(5,4)6,41		6(12,06)43,3
P. osborni		3(9,3)11	1(3,12)3,6	5(10,27)36,91
Immature naididae		1(3,9)4,6	2(3,12)3,6	
Family: Tubificidae				
Branchiura sowerbyi			1(2,34)2,75	
Limnodrilus claparedianus		1(0,77)0,91	1(0,78)0,91	1(2,57)9,25
L. hoffmisteri				1(0,76)2,75
Tubifex tebifex	3,6	1(3,1)3,6	1(3,12)3,6	2(4,1)14,75
Immature tubificidae		1(3,9)4,5	1(1,56)1,8	
Total oligochaeta	(7,14)0,91	(27,14)31,93	(33,55)39,2	(33,58)120,71
Phylum: Arthropoda Class: Insecta Order: Diptera				

Family: Tabanidae				
Tabanus atratus	6(9,4)11,1	1(9,4)11,1	1(0,78)0,91	1(1,27)4,6
Family: Chironmidae	1(14,3)1,8	7(12,4)14,6	1(1,)7,13	7(10,5)37,8
Chironomus sp. (Larvae)	1(14,3)1,8	7(12,4)14,6	3(6,24)7,33	7(10,5)37,8
Chironomus sp. (pupae)	1(0,37)0,91	1(0,77)0,91	3(2,34)2,75	1(0,25)0,91
Cricotopus sp.		2(1,6)1,8	2(5,46)6,41	1(0,25)0,91
Cryptochironomus sp.	2(14,3)1,8	1(6,96)8,3		5(17,5)62,8
Enfelida sp.				1(1,8)6,4
Glyptoendipes sp.		2(3,9)4,6	1(4,7)5,5	1(1,5)5,5
Microtendipes sp.				1(3,6)12,9
Polypedilum sp.		3(15,5)18,4	1(5,5)6,4	2(6,4)23,1
Tanytarsus sp.				1(1,02)3,6
Dicrotendipes sp.	1(7,14)0,91	1(1,6)1,8		
Order: Coleoptera				
Hydroporus sp.				1(0,5)1,8
Order: Ephemeraptera				
Ephemera donica	1(21,42)2,75	2(2,3)2,8		
Order: Neuroptera				
Climaci areolaris				1(1,02)3,6
Class: Crustacea Order: Ostracoda				
Cypris sp.		1(1,6)1,8	4(14,9)17,5	4(5,9)21,2
Total Arthropoda	(57,16)7,26	(56,03)66,11	(39,92)46,8	(51,51)185,12
Phylum: Mollusca Class: Gastropoda				
Lepyrium shwalteri			1(0,78)0,91	2(1,3)4,6
Lithasia geniculata		1(0,8)0,91		1(0,25)0,91
Lymnaea megasoma	2(21,42)2,75	3(5,4)6,4	2(1,56)1,83	3(2,3)8,25
Physa gyrina	1(7,14)0,91		2(2,34)2,75	2(0,5)1,8
Potamopyrgus coronatus				1(1,3)4,6
Tropicorbis havanensis	1(7,14)0,91		1(3,12)3,6	
Class :Pelecypoda				
Corbicula fluminea		4(3,9)4,6	1(0,78)0,91	2(2,8)10,1
Class: Scaphopoda				
Dentalium octangulatum			1(3,12)3,6	
Total Mollusca	(35,7)4,57	(10,1)11,91	(11,7)13,6	(8,45)30,26
Total Density	12,74	118,25	100,51	340,67
Bio-diversity	1,9	,6	2,52	2,7

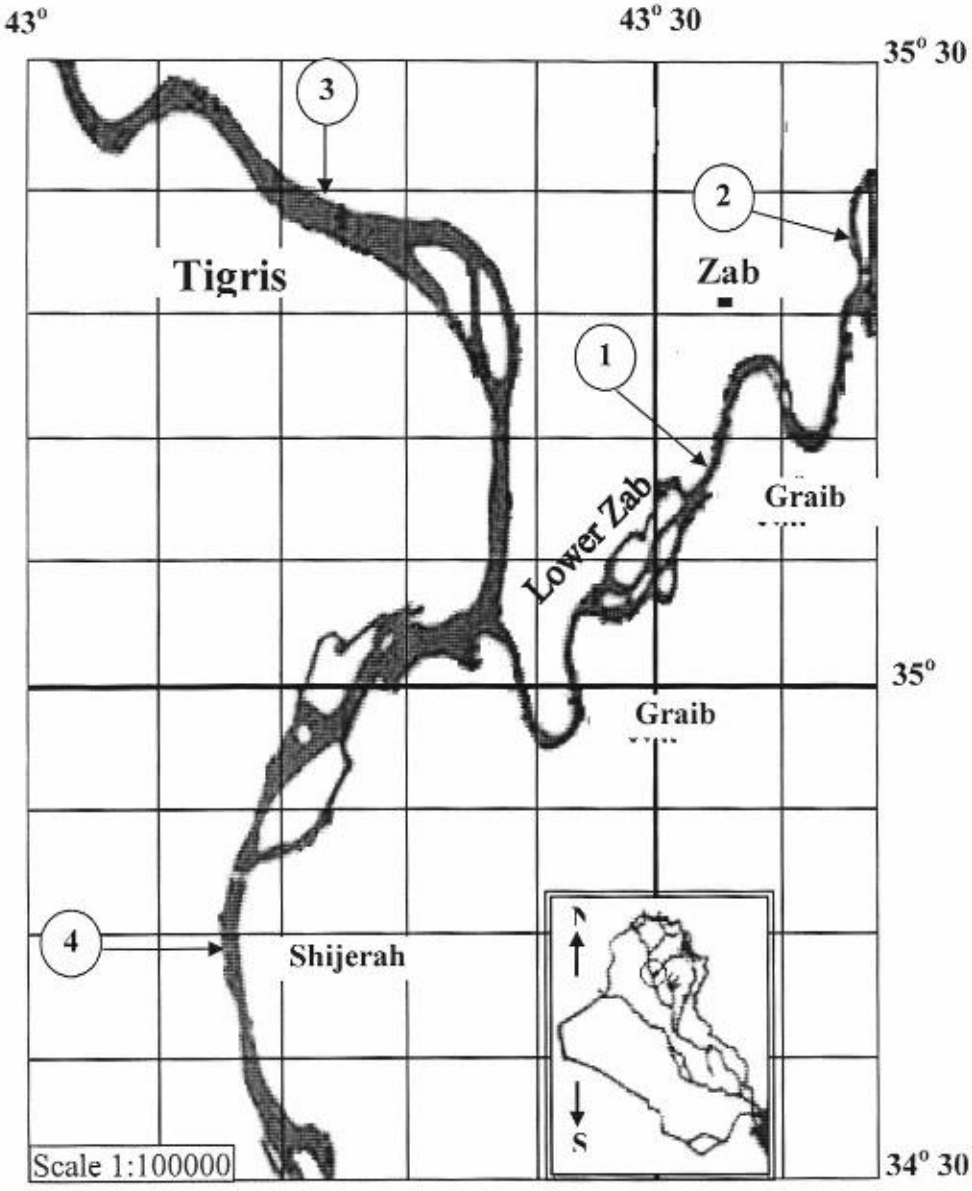
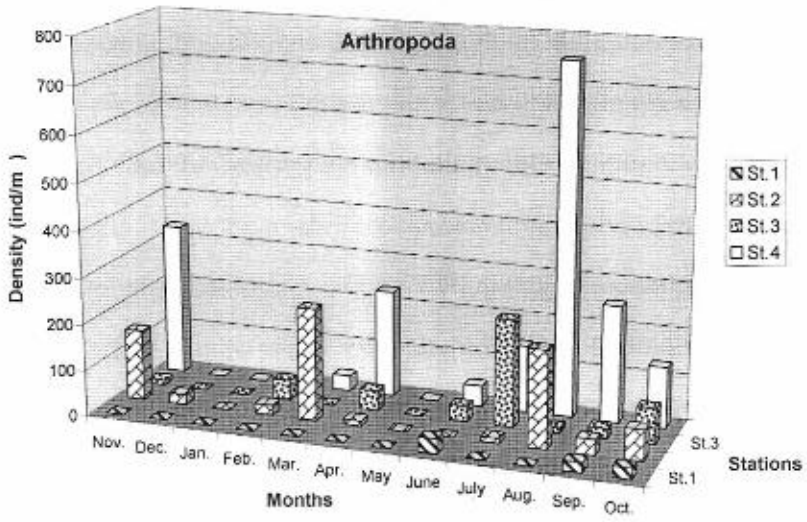
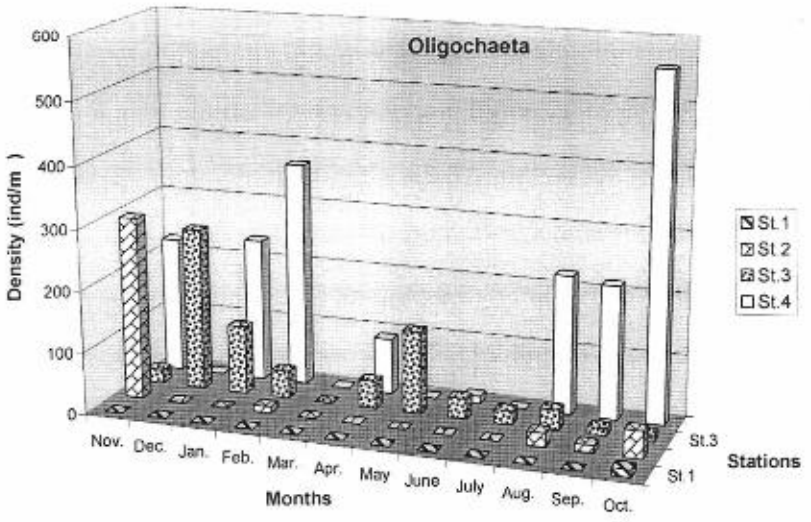


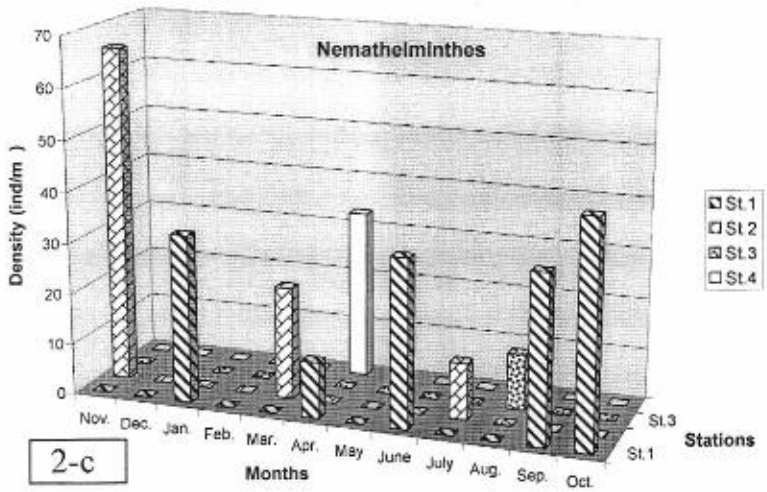
Fig. (1): Study Area; Lower Zab (stations 1,2) & Tigris river (stations 3,4)


Arthropoda
Density (ind/m)
800
700
600
500
400
300
200
100
0
Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct.
Months
St.3
St.1
Stations
St.1
St.2
St.3
St.4

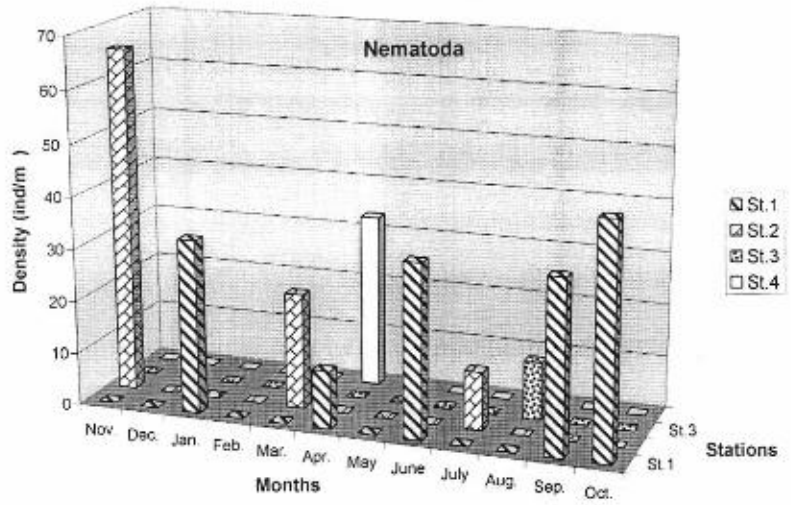
2-a


Oligochaeta
Density (ind/m)
600
500
400
300
200
100
0
Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct.
Months
St.3
St.1
Stations
St.1
St.2
St.3
St.4

2-b



2-c



2-d

Fig.(2) (a, b, c &d): Density of the main benthic invertebrate at the different stations

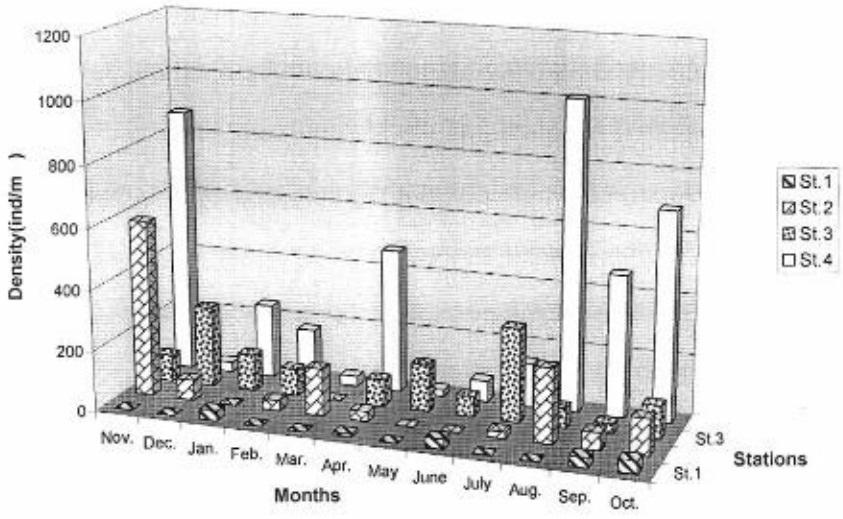


Fig.(3): Density of Benthic invertebrate at the different stations

التأثيرات البيئية لرافد الزاب الأسفل في تنوع لافقريات القاع في نهر دجلة

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الخلاصة

درس التنوع الحياتي للافقريات القاع و بعض الخصائص المياه الفيزيائية و الكيميائية في رافد الزاب الأسفل ونهر دجلة. جمعت النماذج شهرياً خلال المدة من تشرين الثاني عام 2001 و لغاية تشرين الاول 2002. أظهرت نتائج الدراسة ان الكدرة في نهر دجلة قبل مصب الرافد (34.4 وحدة كدرة نفثالية) اعلى مقارنة ببقية المواقع . كان معدل الملوحة لمياه الزاب اعلى من نهر دجلة و بلغ 0.33 % . ان مياه الزاب الاسفل ونهر دجلة ذات تهوية جيدة ،حيث سجل اعلى معدل للاوكسجين في الزاب الاسفل 7.9 ملغم \ لتر.

شخصت 31 وحدة تصنيفية للافقريات القاع ، 14 وحدة منها تعود الى المفصليات و 8 وحدات تصنيفية لكل من قليلة الاهلاب و النواعم .ووحدة تصنيفية واحدة للديدان الخيطية . تراوحت قيم التنوع الحياتي بين 1.9 في رافد الزاب الاسفل و 2.7 في نهر دجلة بعد المصب . سجل اعلى معدل للكثافة السنوية في نهر دجلة بعد المصب وبلغ 359.1 فرد/ م^2 ، و اقل معدل للكثافة السنوية في رافد الزاب الاسفل 12.74 فرد \م^2 .